



- ☐ Tentative Specification  
☒ Preliminary Specification  
☐ Approval Specification

MODEL NO.: V546H1  
SUFFIX: LE5

Customer:

APPROVED BY

SIGNATURE

Name / Title

Note

Please return 1 copy for your confirmation with your signature and comments.

| Approved By        | Checked By | Prepared By  |
|--------------------|------------|--------------|
| Chao-Chun<br>Chung | Ken Wu     | Wei-ting Hsu |

**CONTENTS**

|                                                                                       |    |
|---------------------------------------------------------------------------------------|----|
| REVISION HISTORY .....                                                                | 4  |
| 1. GENERAL DESCRIPTION .....                                                          | 5  |
| 1.1 OVERVIEW .....                                                                    | 5  |
| 1.2 FEATURES .....                                                                    | 5  |
| 1.3 APPLICATION .....                                                                 | 5  |
| 1.4 GENERAL SPECIFICATIONS .....                                                      | 5  |
| 1.5 MECHANICAL SPECIFICATIONS .....                                                   | 6  |
| 2. ABSOLUTE MAXIMUM RATINGS .....                                                     | 7  |
| 2.1 ABSOLUTE RATINGS OF ENVIRONMENT .....                                             | 7  |
| 2.2 ELECTRICAL ABSOLUTE RATINGS .....                                                 | 8  |
| 3. ELECTRICAL CHARACTERISTICS .....                                                   | 9  |
| 3.1.1 TFT LCD MODULE ( $T_a = 25 \pm 2\text{ }^{\circ}\text{C}$ ) .....               | 9  |
| 3.1.2 Vcc Power Dip Condition: .....                                                  | 11 |
| 3.2 BACKLIGHT UNIT .....                                                              | 12 |
| 3.2.1 LED LIGHT BARCHARACTERISTICS ( $T_a = 25 \pm 2\text{ }^{\circ}\text{C}$ ) ..... | 12 |
| 3.2.2 CONVERTER CHARACTERISTICS ( $T_a = 25 \pm 2\text{ }^{\circ}\text{C}$ ) .....    | 12 |
| 3.2.3 CONVERTER INTERFACE CHARACTERISTICS .....                                       | 13 |
| 4. BLOCK DIAGRAM OF INTERFACE .....                                                   | 15 |
| 4.1 TFT LCD MODULE .....                                                              | 15 |
| 5 .INPUT TERMINAL PIN ASSIGNMENT .....                                                | 16 |
| 5.1 TFT LCD Module Input .....                                                        | 16 |
| 5.2 BACKLIGHT UNIT .....                                                              | 19 |
| 5.3 DRIVING BOARD UNIT .....                                                          | 20 |
| 5.4 BLOCK DIAGRAM OF INTERFACE .....                                                  | 23 |
| 5.5 LVDS INTERFACE .....                                                              | 25 |
| 5.6 COLOR DATA INPUT ASSIGNMENT .....                                                 | 26 |
| 6. INTERFACE TIMING .....                                                             | 28 |
| 6.1 INPUT SIGNAL TIMING SPECIFICATIONS .....                                          | 28 |
| 6.2 POWER ON/OFF SEQUENCE .....                                                       | 31 |



|                                              |    |
|----------------------------------------------|----|
| 7. OPTICAL CHARACTERISTICS .....             | 32 |
| 7.1 TEST CONDITIONS .....                    | 32 |
| 7.2 OPTICAL SPECIFICATIONS .....             | 32 |
| 8. DEFINITION OF LABELS .....                | 36 |
| 8.1 CMI MODULE LABEL .....                   | 36 |
| 9. Packaging .....                           | 37 |
| 9.1 PACKING SPECIFICATIONS .....             | 37 |
| 9.2 PACKING METHOD .....                     | 37 |
| 10. PRECAUTIONS .....                        | 39 |
| 10.1 ASSEMBLY AND HANDLING PRECAUTIONS ..... | 39 |
| 10.2 SAFETY PRECAUTIONS .....                | 39 |
| 10.3 SAFETY STANDARDS .....                  | 39 |
| 11. MECHANICAL CHARACTERISTIC .....          | 40 |



## REVISION HISTORY

| Version  | Date        | Page<br>(New)       | Section                   | Description                                                                                                                               |
|----------|-------------|---------------------|---------------------------|-------------------------------------------------------------------------------------------------------------------------------------------|
| Ver. 1.0 | Jul.20, 10' | all                 | all                       | Preliminary Specification was first issued.                                                                                               |
| Ver. 1.1 | Aug.11, 10' | 6<br>12<br>32<br>40 | 1.5<br>3.2.2<br>7.2<br>11 | Update Mechanical Specifications<br>Update Converter Characteristics<br>Update Optical Specifications<br>Update Mechanical Characteristic |



## 1. GENERAL DESCRIPTION

### 1.1 OVERVIEW

V546H1-LE5 is a 54.6" TFT Liquid Crystal Display module with LED Backlight unit and 4ch-LVDS interface.

This module supports 1920 x 1080 HDTV format and can display true 1.073G colors (8-bit + Hi-FRC /color).

The driving board module for backlight is built-in.

### 1.2 FEATURES

- High brightness 450nits
- High contrast ratio 4000:1
- Fast response time Gray to Gray typical 4.5ms
- High color saturation 76% NTSC
- Full HDTV (1920 x 1080 pixels) resolution, true HDTV format
- DE (Data Enable) only mode
- LVDS (Low Voltage Differential Signaling) interface
- Optimized response time for 120/100 Hz frame rate
- Ultra wide viewing angle: Super MVA technology

### 1.3 APPLICATION

- Standard Living Room TVs.
- Public Display Application.
- Home Theater Application.
- MFM Application.

### 1.4 GENERAL SPECIFICATIONS

| Item                   | Specification                                      | Unit  | Note |
|------------------------|----------------------------------------------------|-------|------|
| Active Area            | 1209.6(H) x 680.4(V) (54.6" diagonal)              | mm    | (1)  |
| Bezel Opening Area     | 1217.6 (H) x 688.4 (V)                             | mm    |      |
| Driver Element         | a-si TFT active matrix                             | -     | -    |
| Pixel Number           | 1920x R.G.B. x 1080                                | pixel | -    |
| Pixel Pitch(Sub Pixel) | 0.21(H) x 0.63(V)                                  | mm    | -    |
| Pixel Arrangement      | RGB vertical stripe                                | -     | -    |
| Display Colors         | 1.073G                                             | color | -    |
| Display Operation Mode | Transmissive mode / Normally black                 | -     | -    |
| Surface Treatment      | Anti-Glare coating (11% Low Haze)<br>Hardness (3H) | -     | (2)  |

Note (1) Please refer to the attached drawings in chapter 9 for more information about the front and back outlines.

Note (2) The spec of the surface treatment is temporarily for this phase. CMI reserves the rights to change this feature.

**1.5 MECHANICAL SPECIFICATIONS**

| Item                  |                | Min.   | Typ.   | Max.   | Unit | Note               |
|-----------------------|----------------|--------|--------|--------|------|--------------------|
| Module Size<br>Weight | Horizontal (H) | 1260.1 | 1261.6 | 1263.1 | mm   | Module Size        |
|                       | Vertical (V)   | 730.9  | 732.4  | 733.9  | mm   |                    |
|                       | Depth (D)      | 15.1   | 16.1   | 17.1   | mm   | To Rear            |
|                       |                | 23.2   | 24.2   | 25.2   | mm   | To converter cover |
|                       | Weight         | 13500  | 14300  | 15100  | G    | Weight             |

Note (1) Please refer to the attached drawings for more information of front and back outline dimensions.

Note (2) Module Depth does not include connectors.

**2. ABSOLUTE MAXIMUM RATINGS****2.1 ABSOLUTE RATINGS OF ENVIRONMENT**

| Item                          | Symbol           | Value        |      | Unit | Note     |
|-------------------------------|------------------|--------------|------|------|----------|
|                               |                  | Min.         | Max. |      |          |
| Storage Temperature           | T <sub>ST</sub>  | -20          | +60  | °C   | (1)      |
| Operating Ambient Temperature | T <sub>OP</sub>  | 0            | 50   | °C   | (1), (2) |
| Shock (Non-Operating)         | S <sub>NOP</sub> | ±X, ±Y<br>±Z | 30   | G    | (3), (5) |
|                               |                  |              | 30   |      |          |
| Vibration (Non-Operating)     | V <sub>NOP</sub> | -            | 1.0  | G    | (4), (5) |

Note (1) Temperature and relative humidity range is shown in the figure below.

(a) 90 %RH Max. ( $T_a \leq 40$  °C).

(b) Wet-bulb temperature should be 39 °C Max. ( $T_a > 40$  °C).

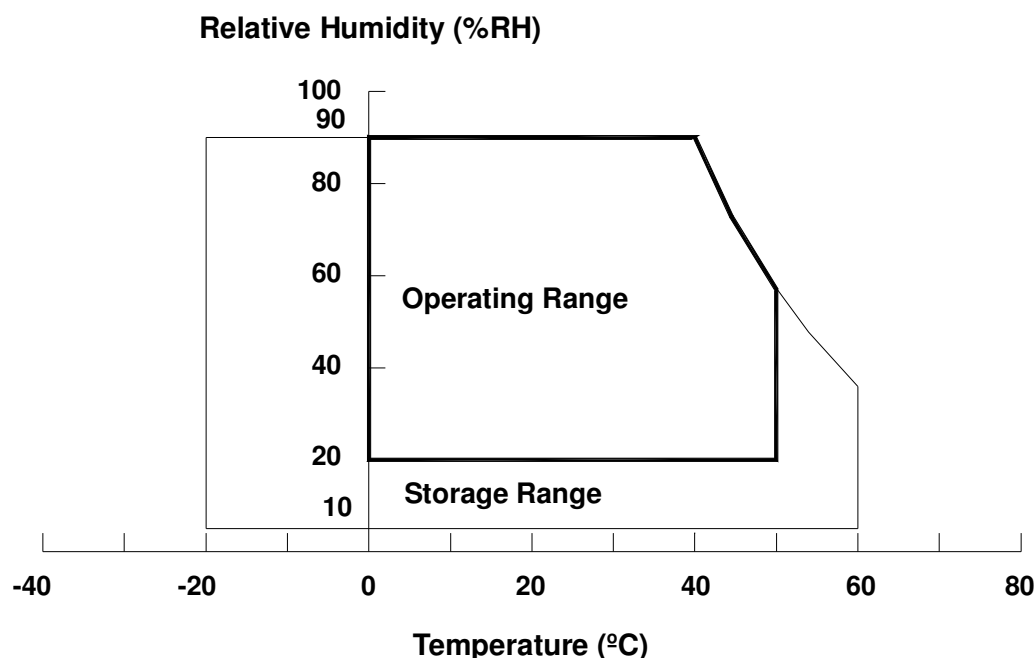
(c) No condensation.

Note (2) The maximum operating temperature is based on the test condition that the surface temperature of display area is less than or equal to 65 °C with LCD module alone in a temperature controlled chamber. Thermal management should be considered in final product design to prevent the surface temperature of display area from being over 65 °C. The range of operating temperature may degrade in case of improper thermal management in final product design.

Note (3) 11 ms, half sine wave, 1 time for  $\pm X$ ,  $\pm Y$ ,  $\pm Z$ .

Note (4) 10 ~ 200 Hz, 10 min, 1 time each X, Y, Z.

Note (5) At testing Vibration and Shock, the fixture in holding the module has to be hard and rigid enough so that the module would not be twisted or bent by the fixture.



**2.2 ELECTRICAL ABSOLUTE RATINGS****2.2.1 TFT LCD MODULE**

| Item                 | Symbol          | Value |      | Unit | Note |
|----------------------|-----------------|-------|------|------|------|
|                      |                 | Min.  | Max. |      |      |
| Power Supply Voltage | V <sub>CC</sub> | -0.3  | 13.5 | V    | (1)  |
| Logic Input Voltage  | V <sub>IN</sub> | -0.3  | 3.6  | V    |      |

**2.2.2 BACKLIGHT CONVERTER UNIT**

| Item                    | Symbol          | Test Condition | Min. | Type | Max. | Unit             | Note |
|-------------------------|-----------------|----------------|------|------|------|------------------|------|
| Light Bar Voltage       | V <sub>W</sub>  | Ta = 25 °C     | -    | -    | 73.5 | V <sub>RMS</sub> |      |
| Converter Input Voltage | V <sub>BL</sub> | -              | 0    | -    | 30   | V                |      |
| Control Signal Level    | -               | -              | -0.3 | -    | 7    | V                |      |

Note (1) Permanent damage to the device may occur if maximum values are exceeded. Function operation should be restricted to the conditions described under Normal Operating Conditions.



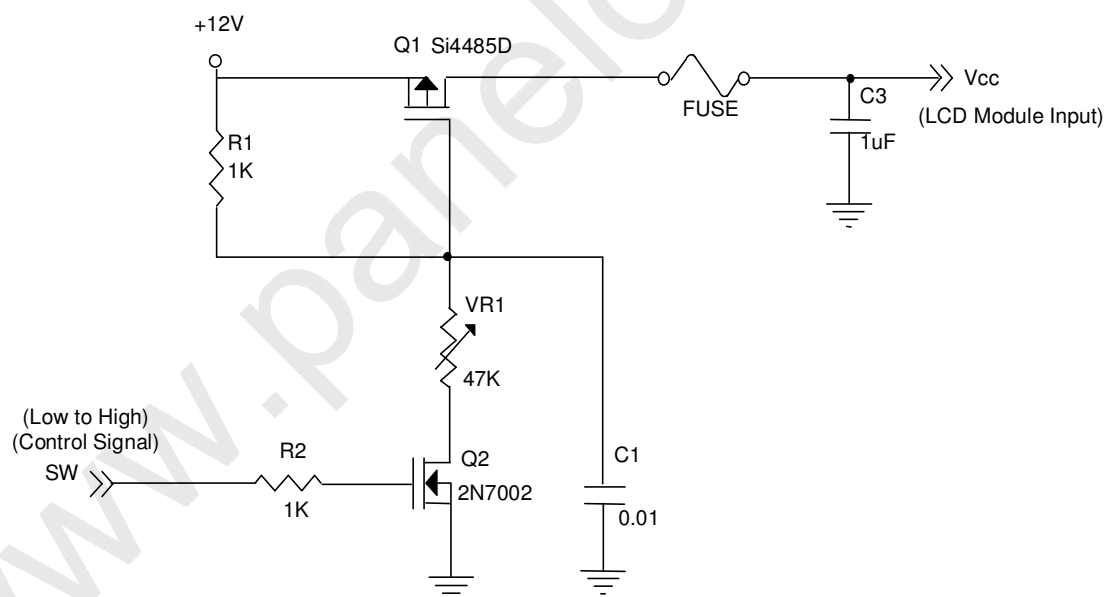
### 3. ELECTRICAL CHARACTERISTICS

#### 3.1.1 TFT LCD MODULE ( $T_a = 25 \pm 2\text{ }^{\circ}\text{C}$ )

| Parameter            |                                           | Symbol     | Value |       |      | Unit | Note |
|----------------------|-------------------------------------------|------------|-------|-------|------|------|------|
|                      |                                           |            | Min.  | Typ.  | Max. |      |      |
| Power Supply Voltage |                                           | $V_{CC}$   | 10.8  | 12.0  | 13.2 | V    | (1)  |
| Rush Current         |                                           | $I_{RUSH}$ | -     | 3.3   | 5    | A    | (2)  |
| Power Supply Current | White                                     | $I_{CC}$   | -     | 0.584 | 0.8  | A    | (3)  |
|                      | Black                                     |            | -     | 0.425 | 0.6  | A    |      |
|                      | Horizontal one line stripe                |            | -     | 1.17  | 1.55 | A    |      |
| LVDS Interface       | Differential Input High Threshold Voltage | $V_{LVTH}$ | +100  | -     | -    | mV   | (4)  |
|                      | Differential Input Low Threshold Voltage  | $V_{LVTL}$ | -     | -     | -100 | mV   |      |
|                      | Common Input Voltage                      | $V_{CM}$   | 1.0   | 1.2   | 1.4  | V    |      |
|                      | Differential input voltage (Single-End)   | $ V_{ID} $ | 200   | -     | 600  | mV   |      |
|                      | Terminating Resistor                      | $R_T$      | -     | 100   | -    | ohm  |      |
| CMOS Interface       | Input High Threshold Voltage              | $V_{IH}$   | 2.7   | -     | 3.3  | V    |      |
|                      | Input Low Threshold Voltage               | $V_{IL}$   | 0     | -     | 0.7  | V    |      |

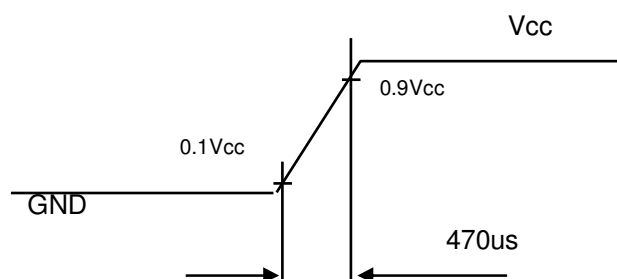
Note (1) The module should be always operated within the above ranges.

Note (2) Measurement condition:



Note (3) The specified power supply current is under the conditions at  $V_{CC} = 12\text{V}$ ,  $T_a = 25 \pm 2\text{ }^{\circ}\text{C}$ ,  $f_v = 120\text{ Hz}$ , whereas a power dissipation check pattern below is displayed.

Vcc rising time is 470us



a. White Pattern



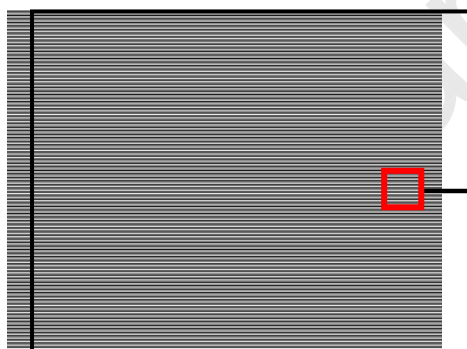
Active Area

b. Black Pattern



Active Area

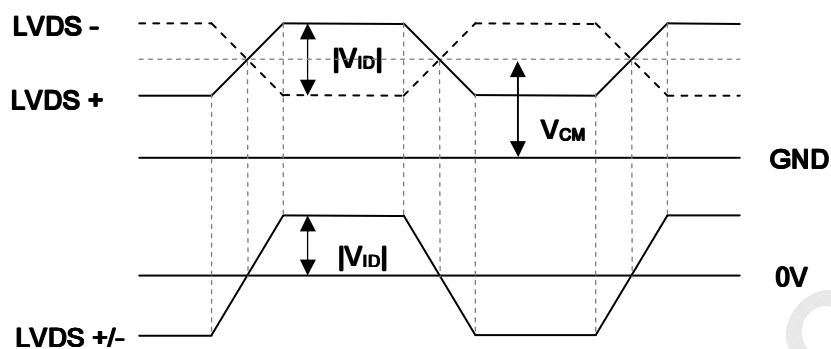
c. Horizontal one line stripe



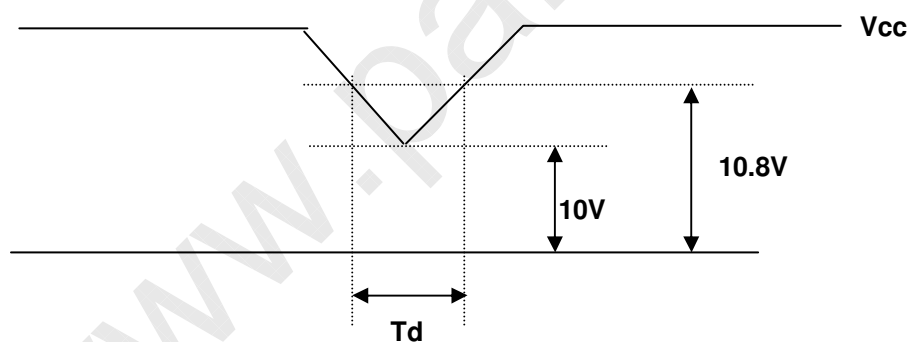
Active Area

|   |   |   |   |   |   |   |   |
|---|---|---|---|---|---|---|---|
| R | G | B | R | G | B | R | G |
| R | G | B | R | G | B | R | G |
| R | G | B | R | G | B | R | G |
| R | G | B | R | G | B | R | G |
| R | G | B | R | G | B | R | G |
| R | G | B | R | G | B | R | G |
| R | G | B | R | G | B | R | G |
| R | G | B | R | G | B | R | G |

Note (4) The LVDS input characteristics are as follows:



### 3.1.2 Vcc Power Dip Condition:



Dip condition:  $10V \leq V_{cc} \leq 10.8V$ ,  $T_d \leq 20ms$

### 3.2 BACKLIGHT UNIT

#### 3.2.1 LED LIGHT BAR CHARACTERISTICS (Ta = 25 ± 2 °C)

| Parameter         | Symbol         | Value |      |       | Unit | Note                   |
|-------------------|----------------|-------|------|-------|------|------------------------|
|                   |                | Min.  | Typ. | Max.  |      |                        |
| Light Bar Voltage | V <sub>W</sub> | -     | -    | 73.5  | V    | I <sub>L</sub> = 120mA |
| Forward Voltage   | V <sub>f</sub> | 3.0   | -    | 3.5   | V    | I <sub>L</sub> = 120mA |
| LED Current       | I <sub>L</sub> | 112.8 | 120  | 127.2 | mA   |                        |

#### 3.2.2 CONVERTER CHARACTERISTICS (Ta = 25 ± 2 °C)

| Parameter               | Symbol           | Value |      |      | Unit            | Note                                                |
|-------------------------|------------------|-------|------|------|-----------------|-----------------------------------------------------|
|                         |                  | Min.  | Typ. | Max. |                 |                                                     |
| Power Consumption       | P <sub>BL</sub>  | -     | 145  | 167  | W               | (1), (2) I <sub>L</sub> = 120 mA                    |
| Converter Input Voltage | V <sub>BL</sub>  | 22.8  | 24   | 25.2 | V <sub>DC</sub> |                                                     |
| Converter Input Current | I <sub>BL</sub>  | -     | 6    | 7    | A               | <b>Non Dimming</b>                                  |
| Input Inrush Current    | -                | -     | -    | 9.39 | A               | V <sub>BL</sub> =24V, (I <sub>L</sub> =typ.)<br>(3) |
| Dimming Frequency       | F <sub>B</sub>   | 150   | 160  | 170  | Hz              |                                                     |
| Minimum Duty Ratio      | D <sub>MIN</sub> | 5     | 10   | -    | %               | (4)                                                 |

Note (1) The power supply capacity should be higher than the total converter power consumption P<sub>BL</sub>.

Since the pulse width modulation (PWM) mode was applied for backlight dimming, the driving current changed as PWM duty on and off. The transient response of power supply should be considered for the changing loading when converter dimming.

Note (2) The measurement condition of Max. value is based on 55" backlight unit under input voltage 24V, average LED current 120 mA and lighting 1 hour later.

Note (3) The duration of rush current is about 30ms.

Note (4) 5% minimum duty ratio is only valid for electrical operation.



## 3.2.3 CONVERTER INTERFACE CHARACTERISTICS

| Parameter                    |                  | Symbol | Test Condition | Value |      |      | Unit | Note                   |
|------------------------------|------------------|--------|----------------|-------|------|------|------|------------------------|
|                              |                  |        |                | Min.  | Typ. | Max. |      |                        |
| On/Off Control Voltage       | ON               | VBLON  | —              | 2.0   | —    | 5.0  | V    |                        |
|                              | OFF              |        | —              | 0     | —    | 0.8  | V    |                        |
| Internal PWM Control Voltage | MAX              | VIPWM  | —              | 3.15  | —    | 3.45 | V    | maximum duty ratio     |
|                              | MIN              |        | —              | —     | 0    | —    | V    | minimum duty ratio     |
| Internal PWM Ripple Voltage  |                  | -      | —              | —     | —    | TBD  | mV   | Peak to Peak (1)       |
| External PWM Control Voltage | HI               | VEPWM  | —              | 2.0   | —    | 5.0  | V    | Duty on                |
|                              | LO               |        | —              | 0     | —    | 0.8  | V    | Duty off               |
| Status Signal                | HI               | Status | —              | 3.0   | 3.3  | 3.6  | V    | Normal                 |
|                              | LO               |        | —              | 0     | —    | 0.8  | V    | Abnormal               |
| VBL Rising Time              |                  | Tr1    | —              | 30    | —    | —    | ms   | 10%-90%V <sub>BL</sub> |
| VBL Falling Time             |                  | Tf1    | —              | 30    | —    | —    | ms   |                        |
| Control Signal Rising Time   |                  | Tr     | —              | —     | —    | 100  | ms   |                        |
| Control Signal Falling Time  |                  | Tf     | —              | —     | —    | 100  | ms   |                        |
| PWM Signal Rising Time       |                  | TPWMR  | —              | —     | —    | 50   | us   |                        |
| PWM Signal Falling Time      |                  | TPWMF  | —              | —     | —    | 50   | us   |                        |
| Input Impedance              |                  | Rin    | —              | 1     | —    | —    | MΩ   |                        |
| PWM Delay Time               |                  | TPWM   | —              | 100   | —    | —    | ms   |                        |
| BLON Delay Time              | T <sub>on</sub>  |        | —              | 300   | —    | —    | ms   |                        |
|                              | T <sub>on1</sub> |        | —              | 300   | —    | —    | ms   |                        |
| BLON Off Time                |                  | Toff   | —              | 300   | —    | —    | ms   |                        |

Note (1) Backlight flicker or flash may be occurred if the ripple voltage of internal PWM signal is over Max. value.

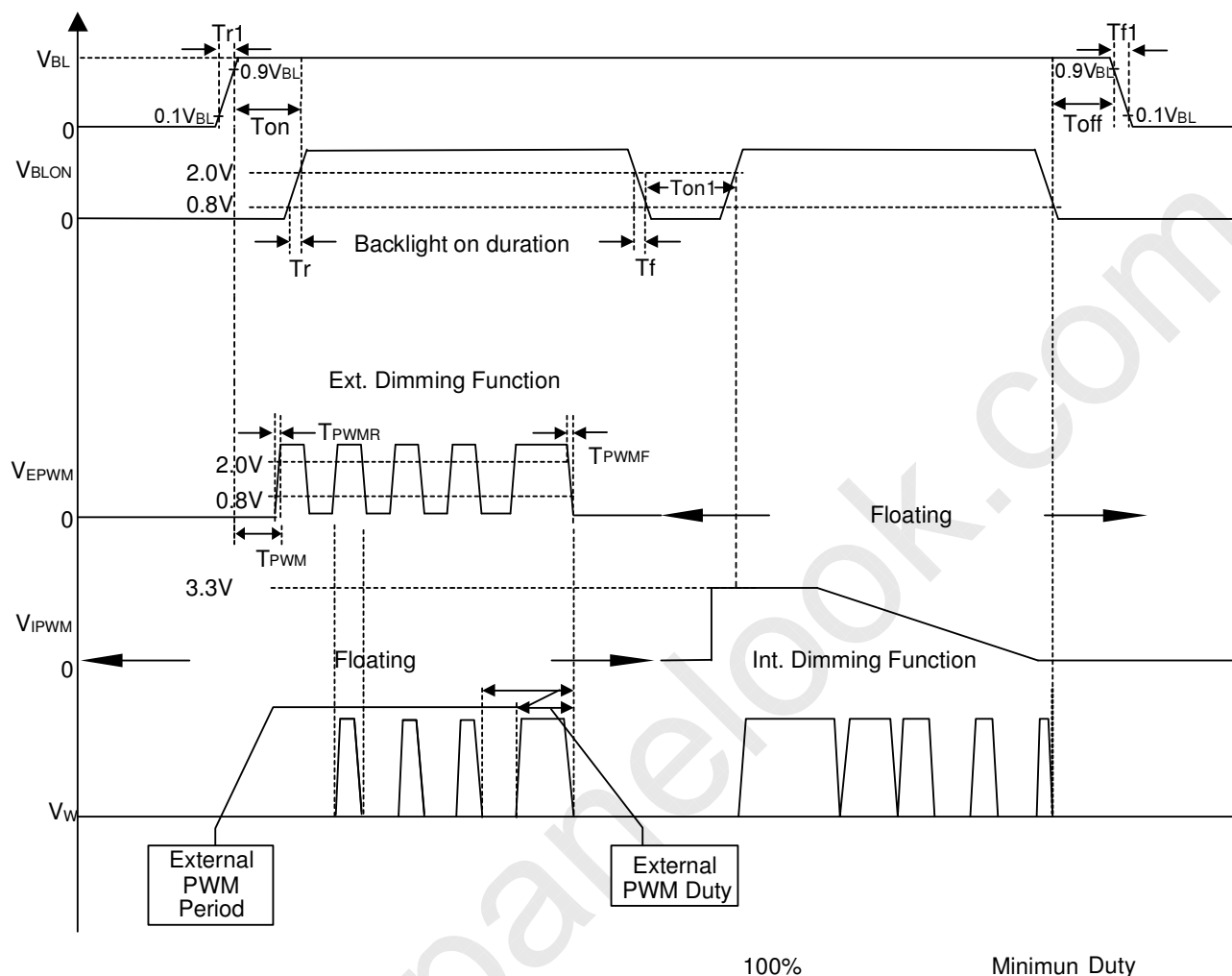
Note (2) The Dimming signal should be valid before backlight turns on by BLON signal. It is inhibited to change the internal/external PWM signal during backlight turn on period.

Note (3) The power sequence and control signal timing are shown in the following figure. For a certain reason, the converter has a possibility to be damaged with wrong power sequence and control signal timing.

Note (4) While system is turned ON or OFF, the power sequences must follow as below descriptions:

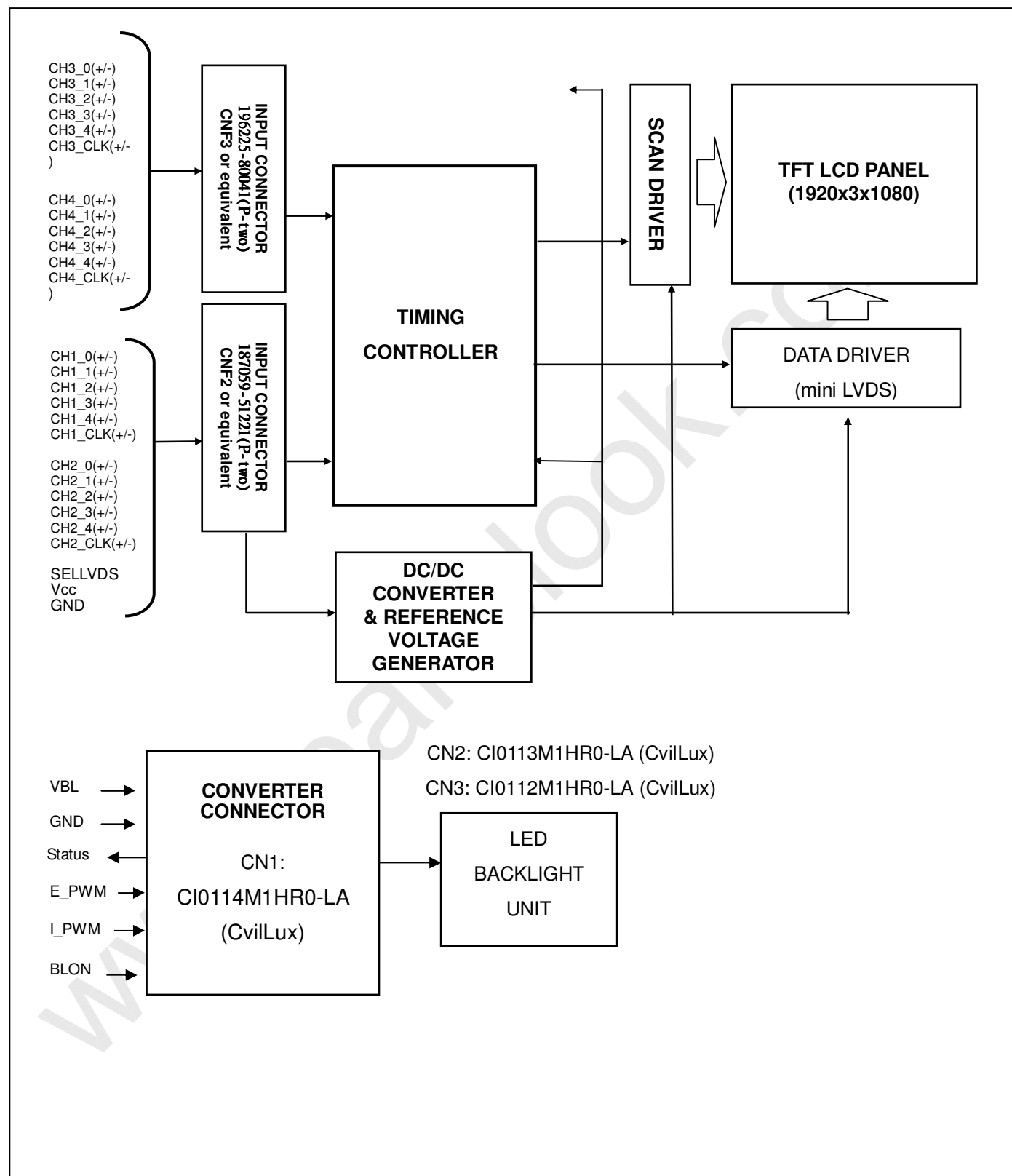
Turn ON sequence: VBL → PWM signal → BLON

Turn OFF sequence: BLOFF → PWM signal → VBL



## 4. BLOCK DIAGRAM OF INTERFACE

### 4.1 TFT LCD MODULE



## 5 .INPUT TERMINAL PIN ASSIGNMENT

### 5.1 TFT LCD Module Input

CNF2 Connector Pin Assignment (187059-51221(P-two) or equivalent)

| Pin | Name    | Description                                                | Note |
|-----|---------|------------------------------------------------------------|------|
| 1   | GND     | Ground                                                     |      |
| 2   | N.C.    | No Connection                                              | (1)  |
| 3   | N.C.    | No Connection                                              | (1)  |
| 4   | N.C.    | No Connection                                              | (1)  |
| 5   | N.C.    | No Connection                                              | (1)  |
| 6   | N.C.    | No Connection                                              | (1)  |
| 7   | SELLVDS | LVDS Data Format Selection                                 | (2)  |
| 8   | N.C.    | No Connection                                              | (1)  |
| 9   | N.C.    | No Connection                                              | (1)  |
| 10  | N.C.    | No Connection                                              | (1)  |
| 11  | GND     | Ground                                                     |      |
| 12  | CH1[0]- | First pixel Negative LVDS differential data input. Pair 0  |      |
| 13  | CH1[0]+ | First pixel Positive LVDS differential data input. Pair 0  |      |
| 14  | CH1[1]- | First pixel Negative LVDS differential data input. Pair 1  |      |
| 15  | CH1[1]+ | First pixel Positive LVDS differential data input. Pair 1  |      |
| 16  | CH1[2]- | First pixel Negative LVDS differential data input. Pair 2  |      |
| 17  | CH1[2]+ | First pixel Positive LVDS differential data input. Pair 2  |      |
| 18  | GND     | Ground                                                     |      |
| 19  | CH1CLK- | First pixel Negative LVDS differential clock input.        |      |
| 20  | CH1CLK+ | First pixel Positive LVDS differential clock input.        |      |
| 21  | GND     | Ground                                                     |      |
| 22  | CH1[3]- | First pixel Negative LVDS differential data input. Pair 3  |      |
| 23  | CH1[3]+ | First pixel Positive LVDS differential data input. Pair 3  |      |
| 24  | CH1[4]- | First pixel Negative LVDS differential data input. Pair 4  |      |
| 25  | CH1[4]+ | First pixel Positive LVDS differential data input. Pair 4  |      |
| 26  | N.C.    | No Connection                                              | (1)  |
| 27  | N.C.    | No Connection                                              | (1)  |
| 28  | CH2[0]- | Second pixel Negative LVDS differential data input. Pair 0 |      |



|    |         |                                                            |     |
|----|---------|------------------------------------------------------------|-----|
| 29 | CH2[0]+ | Second pixel Positive LVDS differential data input. Pair 0 |     |
| 30 | CH2[1]- | Second pixel Negative LVDS differential data input. Pair 1 |     |
| 31 | CH2[1]+ | Second pixel Positive LVDS differential data input. Pair 1 |     |
| 32 | CH2[2]- | Second pixel Negative LVDS differential data input. Pair 2 |     |
| 33 | CH2[2]+ | Second pixel Positive LVDS differential data input. Pair 2 |     |
| 34 | GND     | Ground                                                     |     |
| 35 | CH2CLK- | Second pixel Negative LVDS differential clock input.       |     |
| 36 | CH2CLK+ | Second pixel Positive LVDS differential clock input.       |     |
| 37 | GND     | Ground                                                     |     |
| 38 | CH2[3]- | Second pixel Negative LVDS differential data input. Pair 3 |     |
| 39 | CH2[3]+ | Second pixel Positive LVDS differential data input. Pair 3 |     |
| 40 | CH2[4]- | Second pixel Negative LVDS differential data input. Pair 4 |     |
| 41 | CH2[4]+ | Second pixel Positive LVDS differential data input. Pair 4 |     |
| 42 | N.C.    | No Connection                                              | (1) |
| 43 | N.C.    | No Connection                                              | (1) |
| 44 | GND     | Ground                                                     |     |
| 45 | GND     | Ground                                                     |     |
| 46 | GND     | Ground                                                     |     |
| 47 | N.C.    | No Connection                                              | (1) |
| 48 | VCC     | +12V power supply                                          |     |
| 49 | VCC     | +12V power supply                                          |     |
| 50 | VCC     | +12V power supply                                          |     |
| 51 | VCC     | +12V power supply                                          |     |

CNF3 Connector Pin Assignment (196225-80041(P-two) or equivalent)

| Pin | Name | Description   | Note |
|-----|------|---------------|------|
| 1   | GND  | Ground        |      |
| 2   | N.C. | No Connection | (1)  |
| 3   | N.C. | No Connection | (1)  |
| 4   | N.C. | No Connection | (1)  |
| 5   | N.C. | No Connection | (1)  |
| 6   | N.C. | No Connection | (1)  |
| 7   | N.C. | No Connection | (1)  |



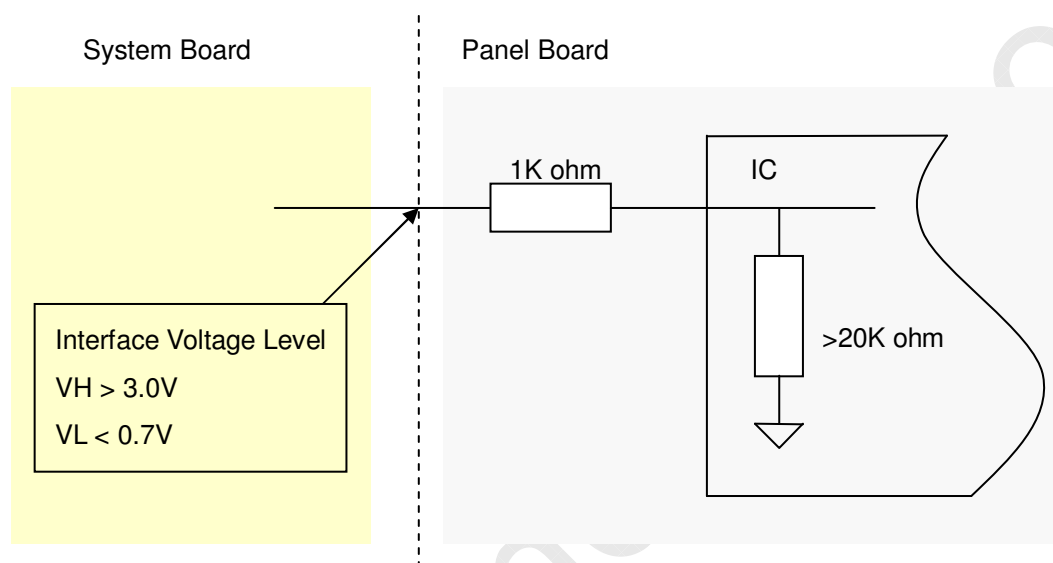
|    |         |                                                            |     |
|----|---------|------------------------------------------------------------|-----|
| 8  | N.C.    | No Connection                                              | (1) |
| 9  | GND     | Ground                                                     |     |
| 10 | CH3[0]- | Third pixel Negative LVDS differential data input. Pair 0  |     |
| 11 | CH3[0]+ | Third pixel Positive LVDS differential data input. Pair 0  |     |
| 12 | CH3[1]- | Third pixel Negative LVDS differential data input. Pair 1  |     |
| 13 | CH3[1]+ | Third pixel Positive LVDS differential data input. Pair 1  |     |
| 14 | CH3[2]- | Third pixel Negative LVDS differential data input. Pair 2  |     |
| 15 | CH3[2]+ | Third pixel Positive LVDS differential data input. Pair 2  |     |
| 16 | GND     | Ground                                                     |     |
| 17 | CH3CLK- | Third pixel Negative LVDS differential clock input.        |     |
| 18 | CH3CLK+ | Third pixel Positive LVDS differential clock input.        |     |
| 19 | GND     | Ground                                                     |     |
| 20 | CH3[3]- | Third pixel Negative LVDS differential data input. Pair 3  |     |
| 21 | CH3[3]+ | Third pixel Positive LVDS differential data input. Pair 3  |     |
| 22 | CH3[4]- | Third pixel Negative LVDS differential data input. Pair 4  |     |
| 23 | CH3[4]+ | Third pixel Positive LVDS differential data input. Pair 4  |     |
| 24 | N.C.    | No Connection                                              | (1) |
| 25 | N.C.    | No Connection                                              | (1) |
| 26 | CH4[0]- | Fourth pixel Negative LVDS differential data input. Pair 0 |     |
| 27 | CH4[0]+ | Fourth pixel Positive LVDS differential data input. Pair 0 |     |
| 28 | CH4[1]- | Fourth pixel Negative LVDS differential data input. Pair 1 |     |
| 29 | CH4[1]+ | Fourth pixel Positive LVDS differential data input. Pair 1 |     |
| 30 | CH4[2]- | Fourth pixel Negative LVDS differential data input. Pair 2 |     |
| 31 | CH4[2]+ | Fourth pixel Positive LVDS differential data input. Pair 2 |     |
| 32 | GND     | Ground                                                     |     |
| 33 | CH4CLK- | Fourth pixel Negative LVDS differential clock input.       |     |
| 34 | CH4CLK+ | Fourth pixel Positive LVDS differential clock input.       |     |
| 35 | GND     | Ground                                                     |     |
| 36 | CH4[3]- | Fourth pixel Negative LVDS differential data input. Pair 3 |     |
| 37 | CH4[3]+ | Fourth pixel Positive LVDS differential data input. Pair 3 |     |
| 38 | CH4[4]- | Fourth pixel Negative LVDS differential data input. Pair 4 |     |

|    |         |                                                            |     |
|----|---------|------------------------------------------------------------|-----|
| 39 | CH4[4]+ | Fourth pixel Positive LVDS differential data input. Pair 4 |     |
| 40 | N.C.    | No Connection                                              | (1) |
| 41 | N.C.    | No Connection                                              | (1) |

Note (1) Reserved for internal use. Please leave it open.

Note (2) High=connect to +3.3V : JEIDA Format ; Low= connect to GND or Open : VESA Format.

Note (3) Interface optional pin has internal scheme as following diagram. Customer should keep the interface voltage level requirement as below.



Note (4) LVDS 4-port Data Mapping

| Port     | Channel of LVDS | Data Stream              |
|----------|-----------------|--------------------------|
| 1st Port | First Pixel     | 1, 5, 9, .....1913, 1917 |
| 2nd Port | Second Pixel    | 2, 6, 10, ....1914, 1918 |
| 3rd Port | Third Pixel     | 3, 7, 11, ....1915, 1919 |
| 4th Port | Fourth Pixel    | 4, 8, 12, ....1916, 1920 |

## 5.2 BACKLIGHT UNIT

The pin configuration for the housing and leader wire is shown in the table below.

CN2 (Housing): CI0113M1HR0-LA (CvilLux)

| Pin No. | Symbol | Description            |
|---------|--------|------------------------|
| 1       | VLED+  | Positive of LED String |
| 2       | NC     | NC                     |
| 3       | N-     | Negative of LED String |
| 4       | N-     |                        |
| 5       | N-     |                        |
| 6       | N-     |                        |
| 7       | NC     | NC                     |
| 8       | N-     | Negative of LED String |
| 9       | N-     |                        |
| 10      | N-     |                        |
| 11      | N-     |                        |
| 12      | NC     | NC                     |
| 13      | VLED+  | Positive of LED String |

CN3 (Housing): CI0112M1HR0-LA (CvilLux)

| Pin No. | Symbol | Description            |
|---------|--------|------------------------|
| 1       | VLED+  | Positive of LED String |
| 2       | NC     | NC                     |
| 3       | N-     | Negative of LED String |
| 4       | N-     |                        |
| 5       | N-     |                        |
| 6       | N-     |                        |
| 7       | N-     | Negative of LED String |
| 8       | N-     |                        |
| 9       | N-     |                        |
| 10      | N-     |                        |
| 11      | NC     | NC                     |
| 12      | VLED+  | Positive of LED String |

Note (1)The backlight interface housing for high voltage side is a model 51281-1094??, manufactured by Molex or equivalent. The mating header on converter part number is 51281-1094??

### 5.3 DRIVING BOARD UNIT

CN1(Header): CI0114M1HR0-LA (CvilLux)

| Pin № | Symbol | Feature                        |
|-------|--------|--------------------------------|
| 1     | VBL    | +24V                           |
| 2     |        |                                |
| 3     |        |                                |
| 4     |        |                                |
| 5     |        |                                |
| 6     | GND    | GND                            |
| 7     |        |                                |
| 8     |        |                                |
| 9     |        |                                |
| 10    |        |                                |
| 11    | Status | Normal (3.3V)<br>Abnormal (0V) |
| 12    | E_PWM  | External PWM<br>Control        |
| 13    | I_PWM  | Internal PWM<br>Control        |
| 14    | BLON   | BL ON/OFF                      |

Note (1) Pin 12: External PWM control (use pin 12): Pin 13 must open.

Note (2) Pin 13: Internal PWM control (use pin 13): Pin 12 must open.

Note (3) Pin 12 and Pin 13 can't open in the same period.

CN2: CI0113M1HR0-LA (CvilLux)

| Pin № | Symbol | Feature                |
|-------|--------|------------------------|
| 1     | VLED+  | Positive of LED String |
| 2     | NC     | NC                     |

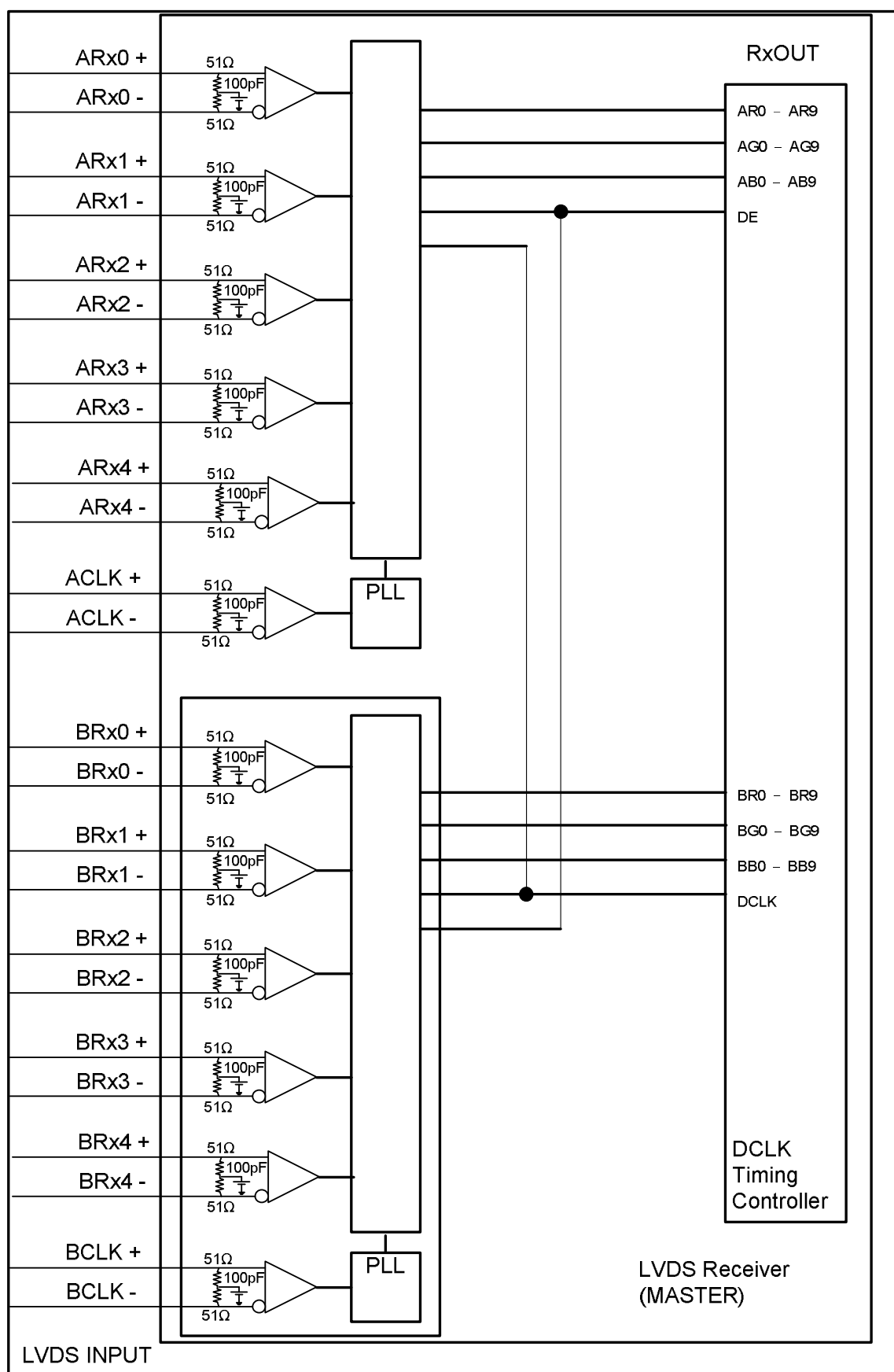


|    |       |                        |
|----|-------|------------------------|
| 3  | N-    | Negative of LED String |
| 4  | N-    |                        |
| 5  | N-    |                        |
| 6  | N-    |                        |
| 7  | NC    | NC                     |
| 8  | N-    | Negative of LED String |
| 9  | N-    |                        |
| 10 | N-    |                        |
| 11 | N-    |                        |
| 12 | NC    | NC                     |
| 13 | VLED+ | Positive of LED String |

CN3: CI0112M1HR0-LA (CvilLux)

| Pin № | Symbol | Feature                |
|-------|--------|------------------------|
| 1     | VLED+  | Positive of LED String |
| 2     | NC     | NC                     |
| 3     | N-     | Negative of LED String |
| 4     | N-     |                        |
| 5     | N-     |                        |
| 6     | N-     |                        |
| 7     | N-     | Negative of LED String |
| 8     | N-     |                        |
| 9     | N-     |                        |
| 10    | N-     |                        |
| 11    | NC     | NC                     |
| 12    | VLED+  | Positive of LED String |

## 5.4 BLOCK DIAGRAM OF INTERFACE



AR0~AR9: First pixel R data

AG0~AG9: First pixel G data

AB0~AB9: First pixel B data

BR0~BR9: Second pixel R data

BG0~BG9: Second pixel G data

BB0~BB9: Second pixel B data

DE: Data enable signal

DCLK: Data clock signal

The third and fourth pixel are followed the same rules.

CR0~CR9: Third pixel R data

CG0~CG9: Third pixel G data

CB0~CB9: Third pixel B data

DR0~DR9: Fourth pixel R data

DG0~DG9: Fourth pixel G data

DB0~DB9: Fourth pixel B data

Note (1) A ~ D channel are first, second, third and fourth pixel respectively.

Note (2) The system must have the transmitter to drive the module.

Note (3) LVDS cable impedance shall be 50 ohms per signal line or about 100 ohms per twist-pair line when it is used differentially.





## 5.6 COLOR DATA INPUT ASSIGNMENT

The brightness of each primary color (red, green and blue) is based on the 10-bit gray scale data input for the color. The higher the binary input, the brighter the color. The table below provides the assignment of the color versus data input.

| Color               |                  | Data Signal |    |    |    |    |    |    |    |    |    |       |    |    |    |    |    |    |    |    |    |      |    |    |    |    |    |    |    |
|---------------------|------------------|-------------|----|----|----|----|----|----|----|----|----|-------|----|----|----|----|----|----|----|----|----|------|----|----|----|----|----|----|----|
|                     |                  | Red         |    |    |    |    |    |    |    |    |    | Green |    |    |    |    |    |    |    |    |    | Blue |    |    |    |    |    |    |    |
|                     |                  |             |    |    |    |    |    |    |    |    |    |       |    |    |    |    |    |    |    |    |    |      |    |    |    |    |    |    |    |
| R9                  | R8               | R7          | R6 | R5 | R4 | R3 | R2 | R1 | R0 | G9 | G8 | G7    | G6 | G5 | G4 | G3 | G2 | G1 | G0 | B9 | B8 | B7   | B6 | B5 | B4 | B3 | B2 | B1 | B0 |
| Basic Colors        | Black            | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|                     | Red              | 1           | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|                     | Green            | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 1     | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 0    | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|                     | Blue             | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 1    | 1  | 1  | 1  | 1  | 1  | 1  | 1  |
|                     | Cyan             | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 1     | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1    | 1  | 1  | 1  | 1  | 1  | 1  | 1  |
|                     | Magenta          | 1           | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 1    | 1  | 1  | 1  | 1  | 1  | 1  | 1  |
|                     | Yellow           | 1           | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1     | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 0    | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|                     | White            | 1           | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1     | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1    | 1  | 1  | 1  | 1  | 1  | 1  | 1  |
| Gray Scale Of Red   | Red (0) / Dark   | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|                     | Red (1)          | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|                     | Red (2)          | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|                     | :                | :           | :  | :  | :  | :  | :  | :  | :  | :  | :  | :     | :  | :  | :  | :  | :  | :  | :  | :  | :  | :    | :  | :  | :  | :  | :  | :  | :  |
|                     | :                | :           | :  | :  | :  | :  | :  | :  | :  | :  | :  | :     | :  | :  | :  | :  | :  | :  | :  | :  | :  | :    | :  | :  | :  | :  | :  | :  | :  |
|                     | Red (1021)       | 1           | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 1  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|                     | Red (1022)       | 1           | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|                     | Red (1023)       | 1           | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
| Gray Scale Of Green | Green (0) / Dark | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|                     | Green (1)        | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 0  | 0    | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|                     | Green (2)        | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|                     | :                | :           | :  | :  | :  | :  | :  | :  | :  | :  | :  | :     | :  | :  | :  | :  | :  | :  | :  | :  | :  | :    | :  | :  | :  | :  | :  | :  | :  |
|                     | :                | :           | :  | :  | :  | :  | :  | :  | :  | :  | :  | :     | :  | :  | :  | :  | :  | :  | :  | :  | :  | :    | :  | :  | :  | :  | :  | :  | :  |
|                     | Green (1021)     | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 1     | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 1  | 0  | 0    | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|                     | Green (1022)     | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 1     | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|                     | Green (1023)     | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 1     | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 0    | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
| Gray Scale Of Blue  | Blue (0) / Dark  | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|                     | Blue (1)         | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 0  | 0  | 1  |
|                     | Blue (2)         | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 0  | 1  | 0  |
|                     | :                | :           | :  | :  | :  | :  | :  | :  | :  | :  | :  | :     | :  | :  | :  | :  | :  | :  | :  | :  | :  | :    | :  | :  | :  | :  | :  | :  | :  |
|                     | :                | :           | :  | :  | :  | :  | :  | :  | :  | :  | :  | :     | :  | :  | :  | :  | :  | :  | :  | :  | :  | :    | :  | :  | :  | :  | :  | :  | :  |
|                     | Blue (1021)      | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 1    | 1  | 1  | 1  | 1  | 1  | 0  | 1  |



|             |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
|-------------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Blue (1022) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 |
| Blue (1023) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |

Note (1) 0: Low Level Voltage, 1: High Level Voltage



## 6. INTERFACE TIMING

### 6.1 INPUT SIGNAL TIMING SPECIFICATIONS

The input signal timing specifications are shown as the following table and timing diagram.

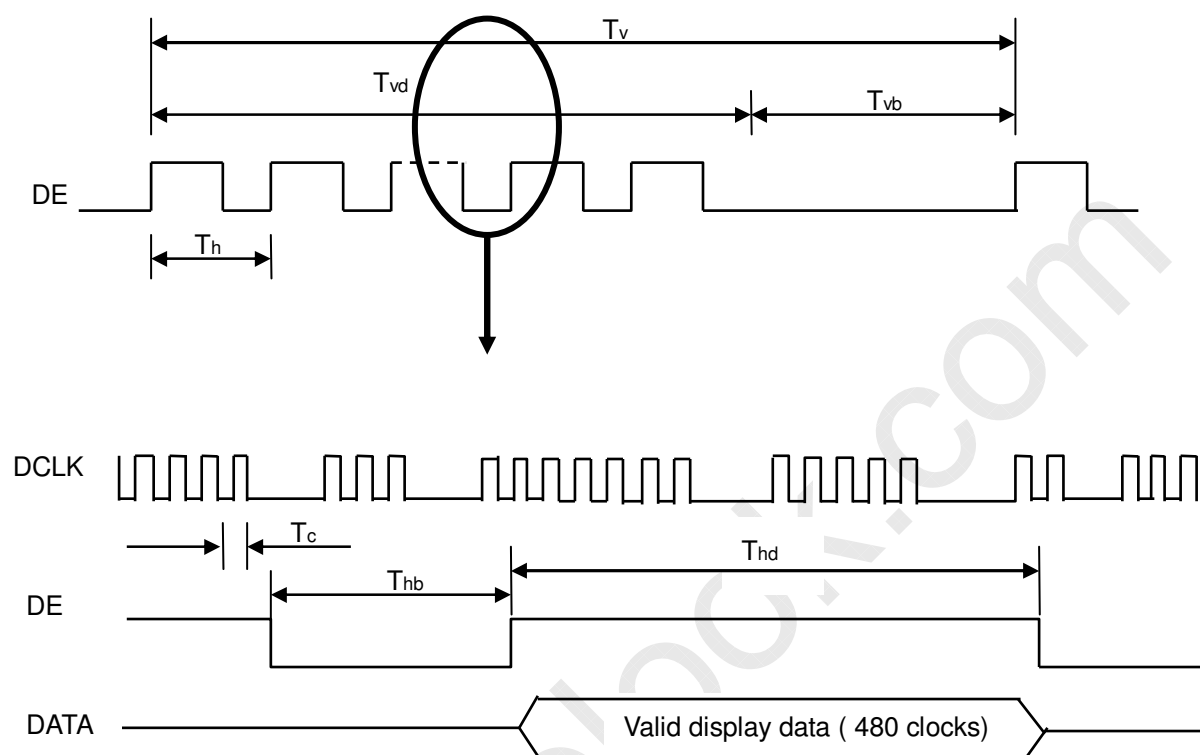
| Signal                         | Item                                 | Symbol                         | Min.                    | Typ.  | Max.                    | Unit           | Note                                       |
|--------------------------------|--------------------------------------|--------------------------------|-------------------------|-------|-------------------------|----------------|--------------------------------------------|
| LVDS Receiver Clock            | Frequency                            | $F_{\text{clk in}}$<br>(=1/TC) | 60                      | 74.25 | 80                      | MHz            |                                            |
|                                | Input cycle to cycle jitter          | $T_{\text{rcl}}$               | -                       | -     | 200                     | ps             | (3)                                        |
|                                | Spread spectrum modulation range     | $F_{\text{clk in\_mod}}$       | $F_{\text{clk in}}-2\%$ | -     | $F_{\text{clk in}}+2\%$ | MHz            | (4)                                        |
|                                | Spread spectrum modulation frequency | $F_{\text{SSM}}$               | -                       | -     | 200                     | KHz            |                                            |
| LVDS Receiver Data             | Setup Time                           | $T_{\text{lv su}}$             | 600                     | -     | -                       | ps             | (5)                                        |
|                                | Hold Time                            | $T_{\text{lv hd}}$             | 600                     | -     | -                       | ps             |                                            |
| Vertical Active Display Term   | Frame Rate                           | $F_{\text{r5}}$                | 97                      | 100   | 103                     | Hz             | (6)                                        |
|                                |                                      | $F_{\text{r6}}$                | 117                     | 120   | 123                     | Hz             |                                            |
|                                | Total                                | $T_{\text{v}}$                 | 1115                    | 1125  | 1135                    | Th             | $T_{\text{v}}=T_{\text{vd}}+T_{\text{vb}}$ |
|                                | Display                              | $T_{\text{vd}}$                | 1080                    | 1080  | 1080                    | Th             | —                                          |
|                                | Blank                                | $T_{\text{vb}}$                | 35                      | 45    | 55                      | Th             | —                                          |
| Horizontal Active Display Term | Total                                | $T_{\text{h}}$                 | 540                     | 550   | 575                     | $T_{\text{c}}$ | $T_{\text{h}}=T_{\text{hd}}+T_{\text{hb}}$ |
|                                | Display                              | $T_{\text{hd}}$                | 480                     | 480   | 480                     | $T_{\text{c}}$ | —                                          |
|                                | Blank                                | $T_{\text{hb}}$                | 60                      | 70    | 95                      | $T_{\text{c}}$ | —                                          |

Note (1) Since the module is operated in DE only mode, Hsync and Vsync input signals should be set to low logic level. Otherwise, this module would operate abnormally.

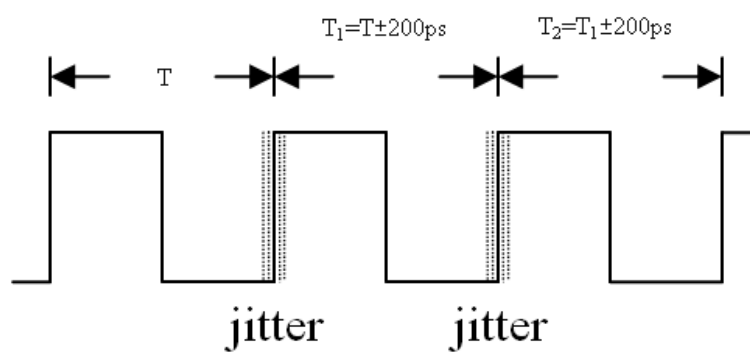
Note (2) Please make sure the range of pixel clock has follow the below equation:

$$F_{\text{clk in}}(\text{max}) \geq F_{\text{r6}} \times T_{\text{v}} \times T_{\text{h}}$$

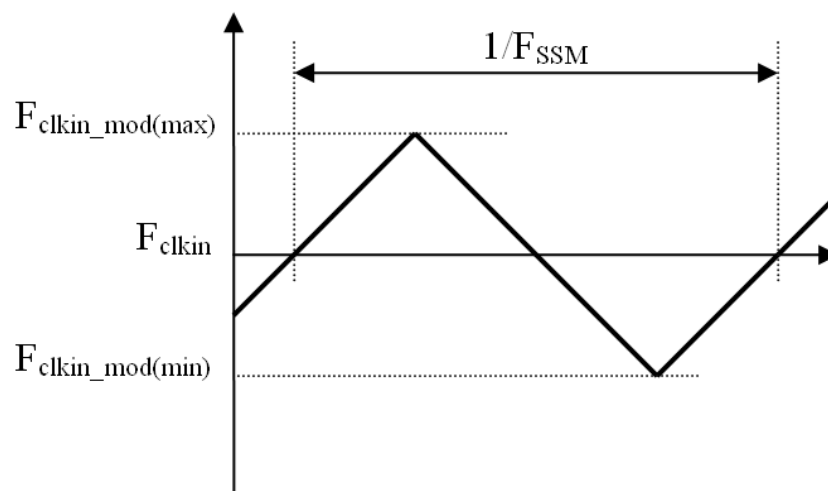
$$F_{\text{r5}} \times T_{\text{v}} \times T_{\text{h}} \geq F_{\text{clk in}}(\text{min})$$

**INPUT SIGNAL TIMING DIAGRAM**

Note (3) The input clock cycle-to-cycle jitter is defined as below figures.  $Trcl = |T_1 - T_1|$

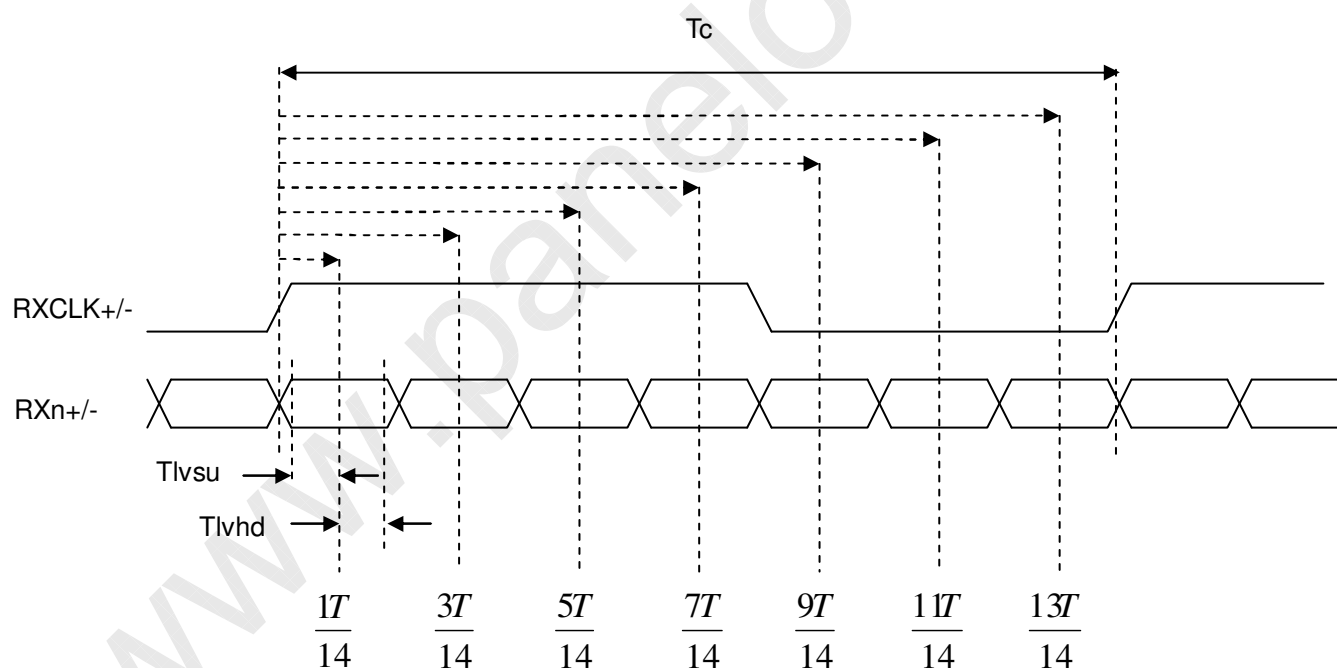


Note (4) The SSCG (Spread spectrum clock generator) is defined as below figures.



Note (5) The LVDS timing diagram and setup/hold time is defined and showing as the following figures.

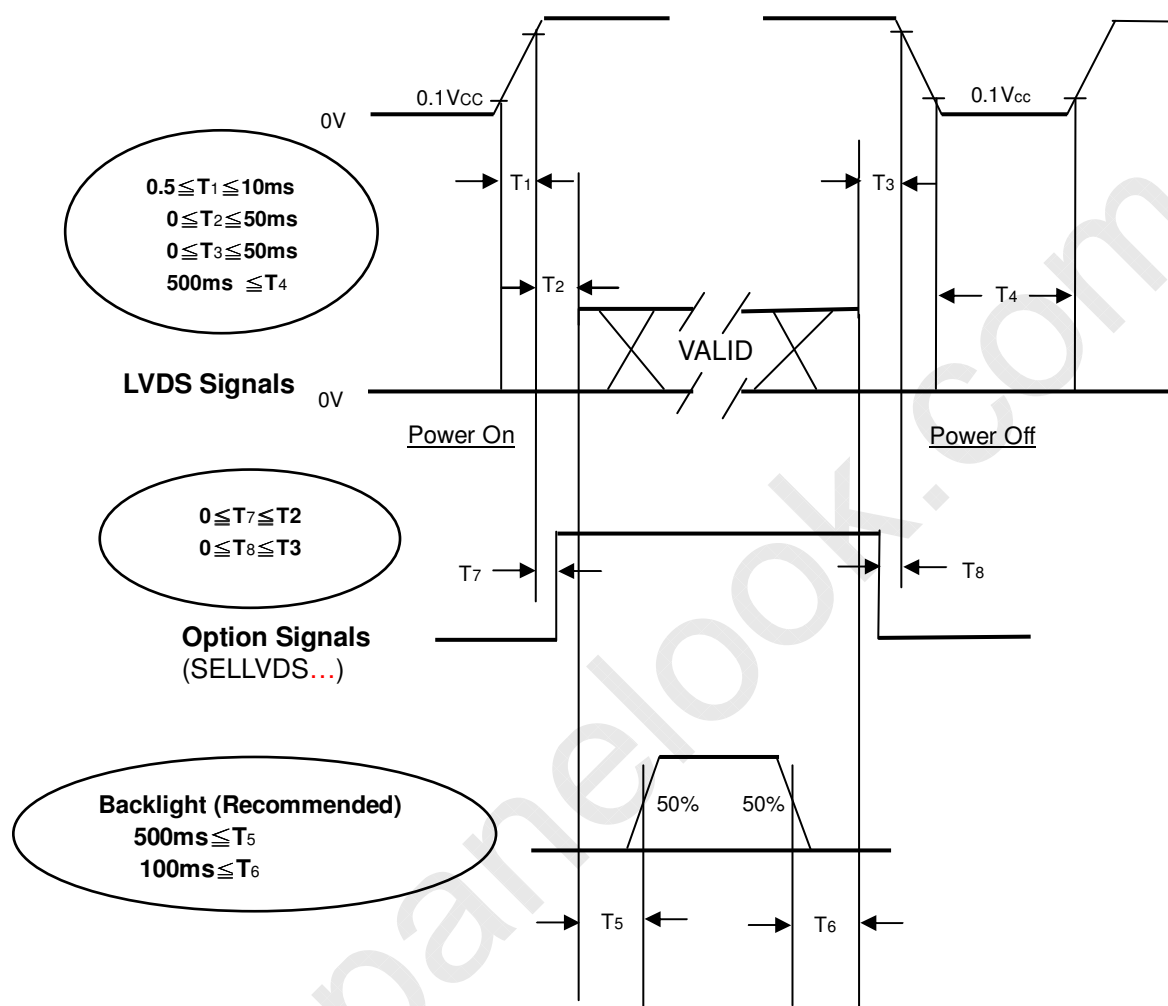
#### LVDS RECEIVER INTERFACE TIMING DIAGRAM



Note (6) : (ODSEL) = H/L or open for 100/120Hz frame rate. Please refer to 5.1 for detail information

## 6.2 POWER ON/OFF SEQUENCE

To prevent a latch-up or DC operation of LCD module, the power on/off sequence should follow the diagram below.



**Power ON/OFF Sequence**

Note:

- (1) The supply voltage of the external system for the module input should follow the definition of V<sub>CC</sub>.
- (2) Apply the lamp voltage within the LCD operation range. When the backlight turns on before the LCD operation or the LCD turns off before the backlight turns off, the display may momentarily become abnormal screen.
- (3) In case of V<sub>CC</sub> is in off level, please keep the level of input signals on the low or high impedance.
- (4) T<sub>4</sub> should be measured after the module has been fully discharged between power off and on period.
- (5) Interface signal shall not be kept at high impedance when the power is on.

## 7. OPTICAL CHARACTERISTICS

### 7.1 TEST CONDITIONS

| Item                | Symbol                                                        | Value | Unit |
|---------------------|---------------------------------------------------------------|-------|------|
| Ambient Temperature | Ta                                                            | 25±2  | °C   |
| Ambient Humidity    | Ha                                                            | 50±10 | %RH  |
| Supply Voltage      | V <sub>CC</sub>                                               | 12V   | V    |
| Input Signal        | According to typical value in "3. ELECTRICAL CHARACTERISTICS" |       |      |
| LED Current         | I <sub>L</sub>                                                | 120   | mA   |

### 7.2 OPTICAL SPECIFICATIONS

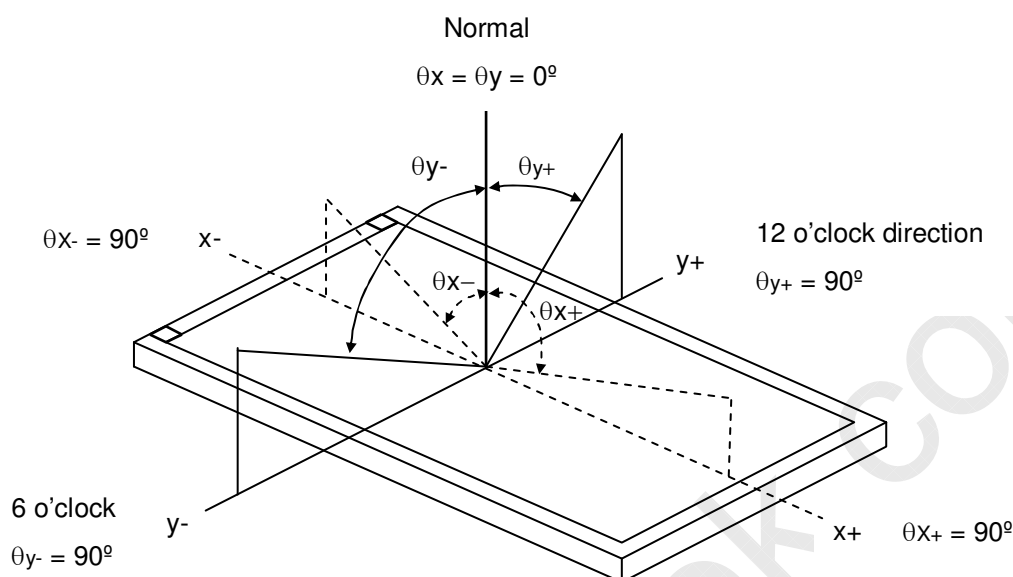
The relative measurement methods of optical characteristics are shown in 7.2. The following items should be measured under the test conditions described in 7.1 and stable environment shown in Note (6).

| Item                      |             | Symbol          | Condition                                                                 | Min.          | Typ.  | Max.          | Unit              | Note     |
|---------------------------|-------------|-----------------|---------------------------------------------------------------------------|---------------|-------|---------------|-------------------|----------|
| Contrast Ratio            |             | CR              | $\theta_x=0^\circ, \theta_Y=0^\circ$<br>Viewing angle at normal direction | 2500          | 4000  | -             | -                 | Note (2) |
| Response Time             |             | Gray to gray    |                                                                           | -             | (6)   | (12)          | ms                | Note (3) |
| Center Luminance of White |             | L <sub>C</sub>  |                                                                           | 350           | 450   | -             | cd/m <sup>2</sup> | Note (4) |
| White Variation           |             | δW              |                                                                           | -             | -     | 1.5           | -                 | Note (7) |
| Cross Talk                |             | CT              |                                                                           | -             | -     | 4             | %                 | Note (5) |
| Color Chromaticity        | Red         | R <sub>x</sub>  |                                                                           | Typ.-<br>0.03 | 0.644 | Typ.+<br>0.03 | -                 | Note (6) |
|                           |             | R <sub>y</sub>  |                                                                           |               | 0.325 |               | -                 |          |
|                           | Green       | G <sub>x</sub>  |                                                                           |               | 0.298 |               | -                 |          |
|                           |             | G <sub>y</sub>  |                                                                           |               | 0.626 |               | -                 |          |
|                           | Blue        | B <sub>x</sub>  |                                                                           |               | 0.152 |               | -                 |          |
|                           |             | B <sub>y</sub>  |                                                                           |               | 0.052 |               | -                 |          |
|                           | White       | W <sub>x</sub>  |                                                                           |               | 0.280 |               | -                 |          |
|                           |             | W <sub>y</sub>  |                                                                           |               | 0.290 |               | -                 |          |
|                           | Color Gamut |                 |                                                                           |               | -     | 76            | -                 | %        |
| Viewing Angle             | Horizontal  | θ <sub>x+</sub> | CR≥20                                                                     | 80            | 88    | -             | Deg.              | Note (1) |
|                           |             | θ <sub>x-</sub> |                                                                           | 80            | 88    | -             |                   |          |
|                           | Vertical    | θ <sub>y+</sub> |                                                                           | 80            | 88    | -             |                   |          |
|                           |             | θ <sub>y-</sub> |                                                                           | 80            | 88    | -             |                   |          |



Note (1) Definition of Viewing Angle ( $\theta_x$ ,  $\theta_y$ ):

Viewing angles are measured by Autronic Conoscope Cono-80.



Note (2) Definition of Contrast Ratio (CR):

The contrast ratio can be calculated by the following expression.

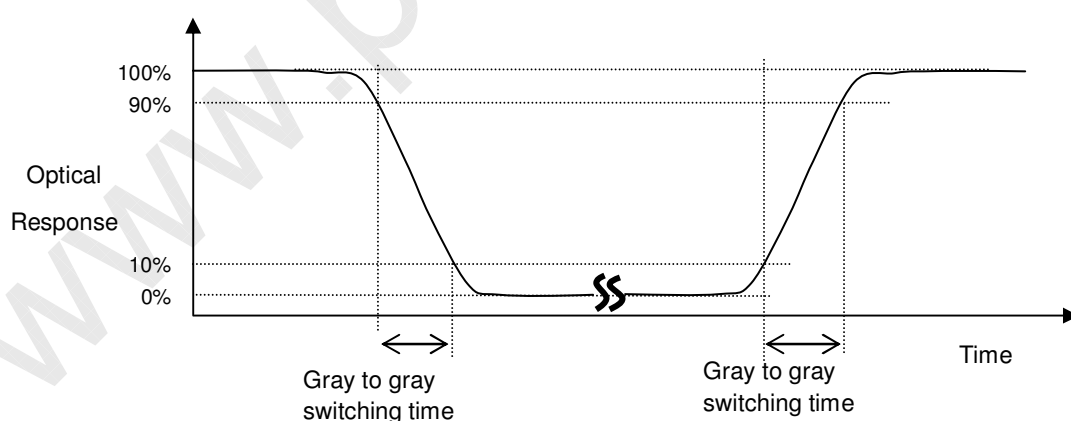
$$\text{Contrast Ratio (CR)} = L_{1023} / L_0$$

$L_{1023}$ : Luminance of gray level 1023

$L_0$ : Luminance of gray level 0

$CR = CR(5)$ , where  $CR(X)$  is corresponding to the Contrast Ratio of the point X at the figure in Note (7)

Note (3) Definition of Gray to Gray Switching Time :



The driving signal means the signal of gray level 0, 127, 255, 383, 511, 639, 767, 895 and 1023.

Gray to gray average time means the average switching time of gray level 0, 127, 255, 383, 511, 639, 767, 895 and 1023 to each other.

Note (4) Definition of Luminance of White ( $L_C$ ):

Measure the luminance of gray level 1023 at center point.

$L_C = L(5)$ , where  $L(x)$  is corresponding to the luminance of the point X at the figure in Note (7).

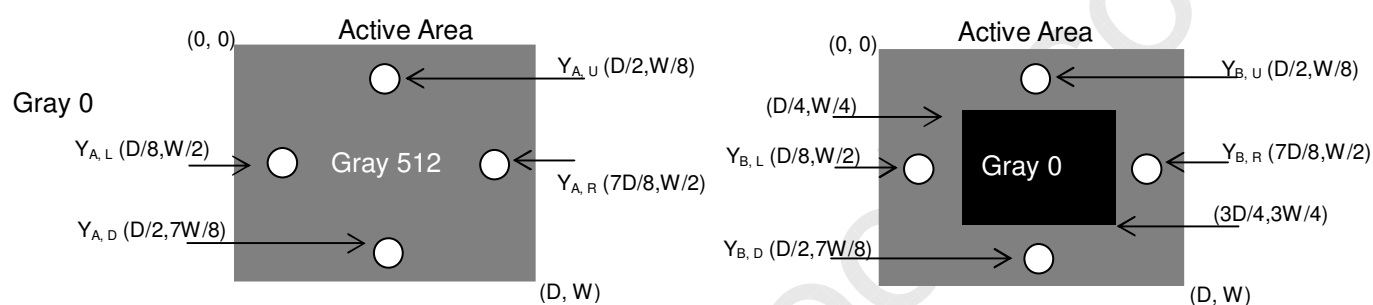
Note (5) Definition of Cross Talk (CT):

$$CT = |Y_B - Y_A| / Y_A \times 100 (\%)$$

Where:

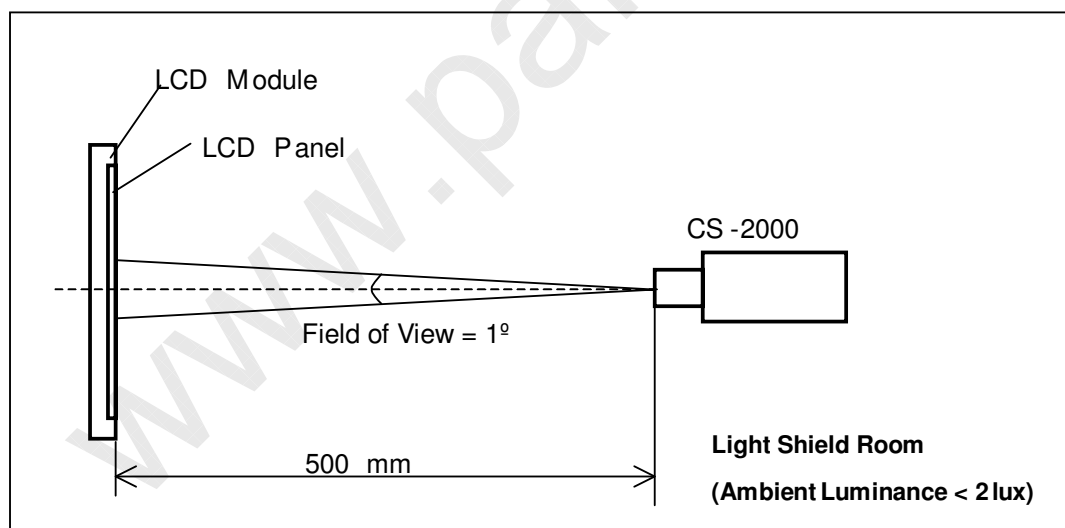
$Y_A$  = Luminance of measured location without gray level 0 pattern ( $\text{cd/m}^2$ )

$Y_B$  = Luminance of measured location with gray level 0 pattern ( $\text{cd/m}^2$ )



Note (6) Measurement Setup:

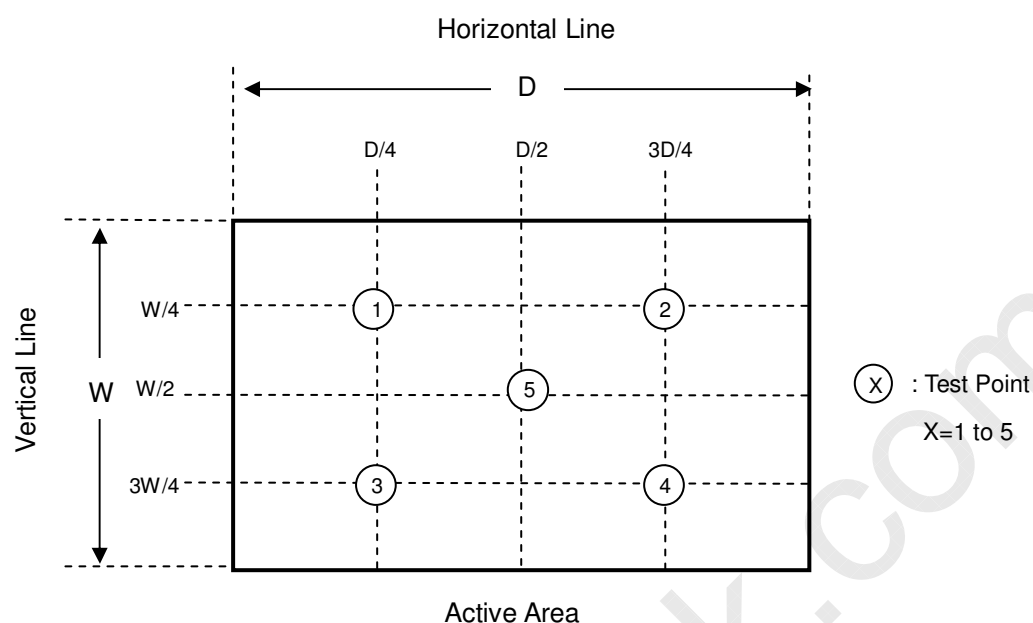
The LCD module should be stabilized at given temperature for 1 hour to avoid abrupt temperature change during measuring. In order to stabilize the luminance, the measurement should be executed after lighting backlight for 1 hour in a windless room.



Note (7) Definition of White Variation ( $\delta W$ ):

Measure the luminance of gray level 1023 at 5 points

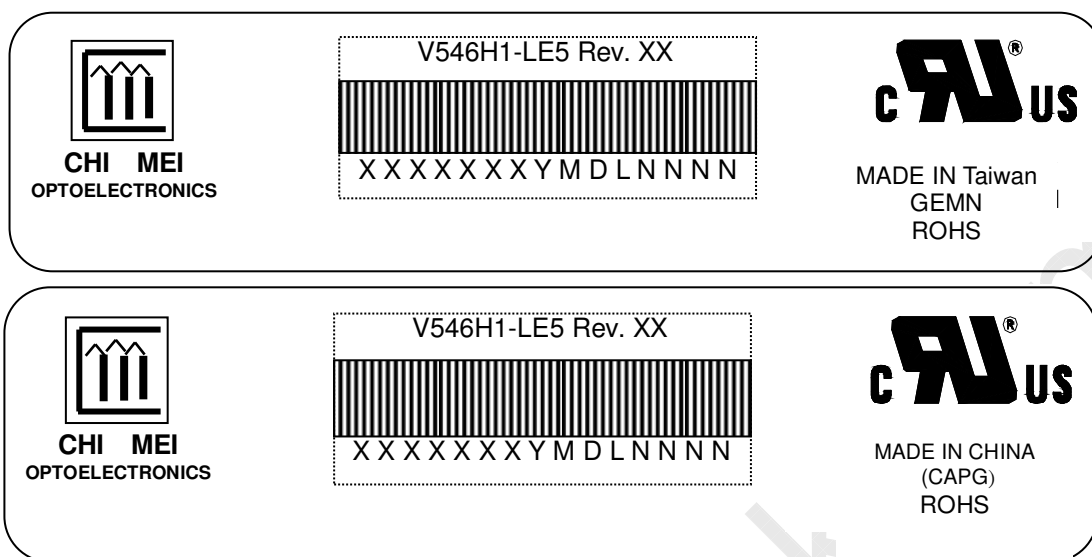
$$\delta W = \text{Maximum} [L(1), L(2), L(3), L(4), L(5)] / \text{Minimum} [L(1), L(2), L(3), L(4), L(5)]$$



## 8. DEFINITION OF LABELS

### 8.1 CMI MODULE LABEL

The barcode nameplate is pasted on each module as illustration, and its definitions are as following explanation.



- (a) Model Name: V546H1-LE5  
(b) Revision: Rev. XX, for example: A0, A1... B1, B2... or C1, C2...etc.  
(c) CMI barcode definition:

Serial ID: XX-XX-X-XX-YMD-L-NNNN

| Code | Meaning          | Description                                                                                                                                                                               |
|------|------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| XX   | CMI internal use | -                                                                                                                                                                                         |
| XX   | Revision         | Cover all the change                                                                                                                                                                      |
| X-XX | CMI internal use | -                                                                                                                                                                                         |
| YMD  | Year, month, day | Year: 2001=1, 2002=2, 2003=3, 2004=4...<br>Month: Jan. ~ Dec.=1, 2, 3, ~, 9, A, B, C<br>Day: 1 <sup>st</sup> to 31 <sup>st</sup> =1, 2, 3, ~, 9, A, B, C, ~, W, X, Y, exclude I, O, and U |
| L    | Product line #   | Line 1=1, Line 2=2, Line 3=3, ...                                                                                                                                                         |
| NNNN | Serial number    | Manufacturing sequence of product                                                                                                                                                         |

## 9. Packaging

### 9.1 PACKING SPECIFICATIONS

- (1) 3 LCD TV modules / 1 Box
- (2) Box dimensions: 1334(L) X 284 (W) X 856 (H)
- (3) Weight: approximately 48.5 Kg (3 modules per box)

### 9.2 PACKING METHOD

Figures 9-1 and 9-2 are the packing method

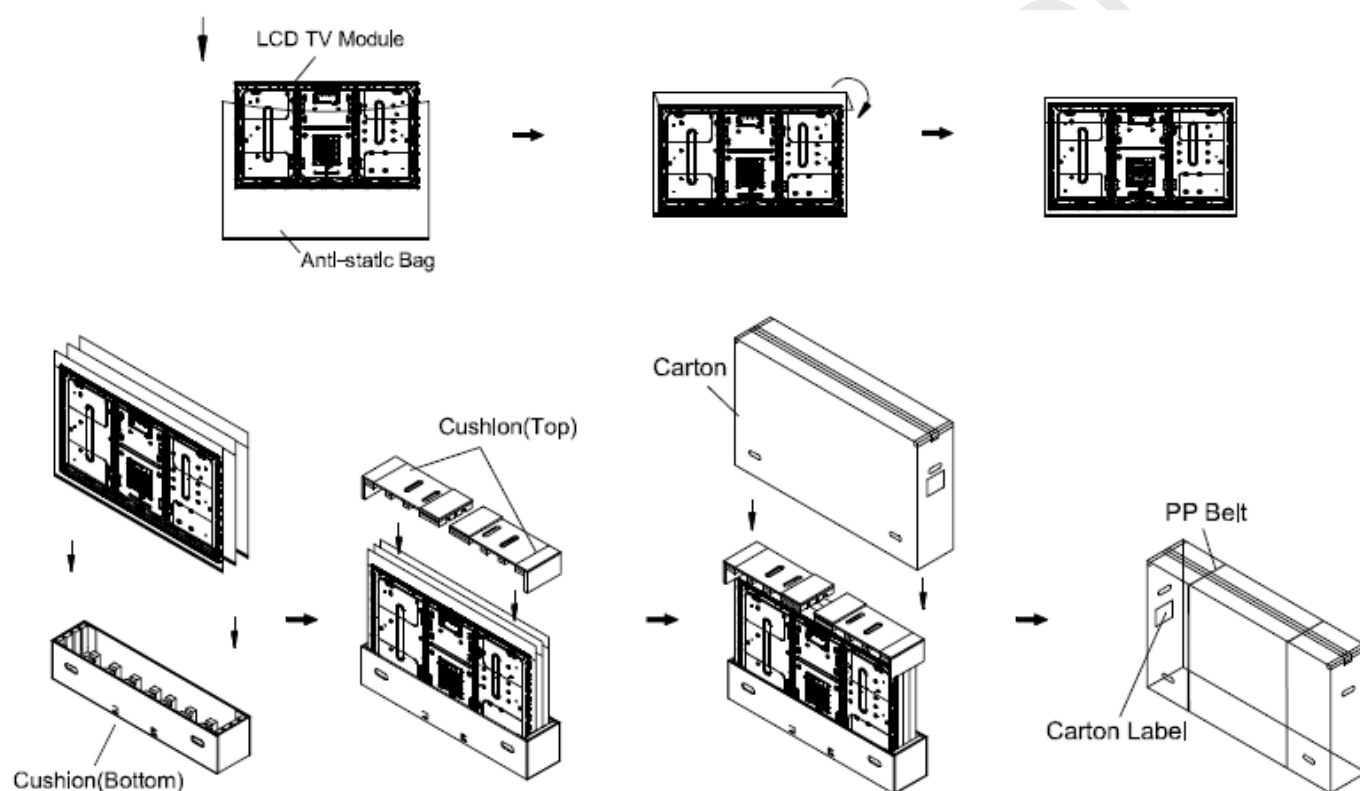


Figure.9-1 packing method

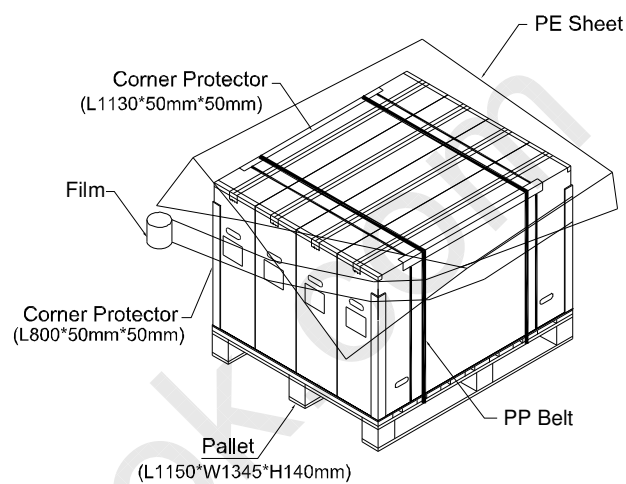
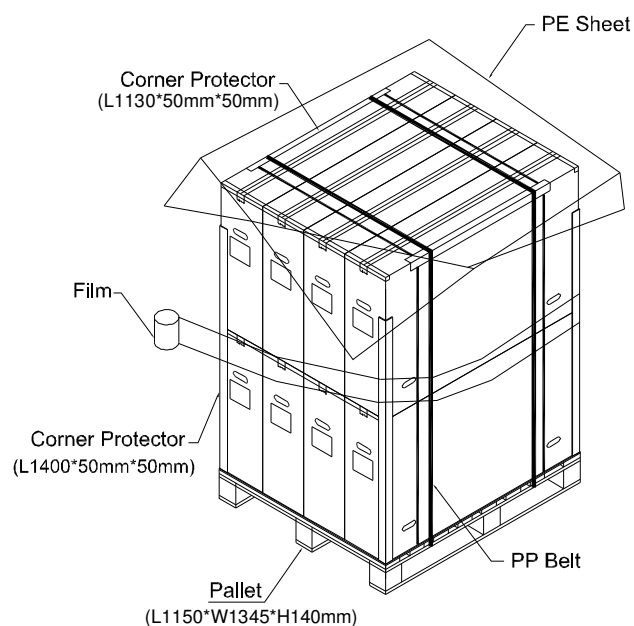
**Sea & Land Transportation****Air Transportation**

Figure. 9-2 Packing method

**10. PRECAUTIONS****10.1 ASSEMBLY AND HANDLING PRECAUTIONS**

- (1) Do not apply rough force such as bending or twisting to the module during assembly.
- (2) It is recommended to assemble or to install a module into the user's system in clean working areas. The dust and oil may cause electrical short or worsen the polarizer.
- (3) Do not apply pressure or impulse to the module to prevent the damage of LCD panel and backlight.
- (4) Always follow the correct power-on sequence when the LCD module is turned on. This can prevent the damage and latch-up of the CMOS LSI chips.
- (5) Do not plug in or pull out the I/F connector while the module is in operation.
- (6) Do not disassemble the module.
- (7) Use a soft dry cloth without chemicals for cleaning, because the surface of polarizer is very soft and easily scratched.
- (8) Moisture can easily penetrate into LCD module and may cause the damage during operation.
- (9) High temperature or humidity may deteriorate the performance of LCD module. Please store LCD modules in the specified storage conditions.
- (10) When ambient temperature is lower than 10°C, the display quality might be reduced. For example, the response time will become slow, and the starting voltage of LED will be higher than that of room temperature.

**10.2 SAFETY PRECAUTIONS**

- (1) The startup voltage of a backlight is over 1000 Volts. It may cause an electrical shock while assembling with the inverter. Do not disassemble the module or insert anything into the backlight unit.
- (2) If the liquid crystal material leaks from the panel, it should be kept away from the eyes or mouth. In case of contact with hands, skin or clothes, it has to be washed away thoroughly with soap.
- (3) After the module's end of life, it is not harmful in case of normal operation and storage.

**10.3 SAFETY STANDARDS**

The LCD module should be certified with safety regulations as follows:

| Regulatory                       | Item | Standard                                        |
|----------------------------------|------|-------------------------------------------------|
| Information Technology equipment | UL   | UL60950-1:2006 or Ed.2:2007                     |
|                                  | cUL  | CAN/CSA C22.2 No.60950-1-03 or 60950-1-07       |
|                                  | CB   | IEC60950-1:2005 / EN60950-1:2006                |
| Audio/Video Apparatus            | UL   | UL60065 Ed.7:2007                               |
|                                  | cUL  | CAN/CSA C22.2 No.60065-03:2006 + A1:2006        |
|                                  | CB   | IEC60065:2001+ A1:2005 / EN60065:2002 + A1:2006 |

If the module displays the same pattern for a long period of time, the phenomenon of image sticking may be occurred.

## 11. MECHANICAL CHARACTERISTIC

